

## CLAIMS

We claim:

1. A polymer electrolyte fuel cell comprising a polymer electrolyte membrane and a pair of electrodes each having a catalytic reaction layer and a gas diffusion layer, said polymer electrolyte membrane being disposed between the pair of electrodes, wherein a hydrogen ion diffusion layer is provided on at least either surface of a catalyst particle or a carrier, which carries the catalyst particle in said catalytic reaction layer, and wherein said hydrogen ion diffusion layer is formed by chemically bonding a silane compound onto at least either surface of said catalyst particle or said carrier, which carries the catalyst particle.
2. A polymer electrolyte fuel cell comprising a polymer electrolyte membrane and a pair of electrodes each having a catalytic reaction layer and a gas diffusion layer, said polymer electrolyte membrane being disposed between the pair of electrodes, wherein a hydrogen ion diffusion layer is provided on at least either surface of a catalyst particle or a carrier, which carries the catalyst particle in said catalytic reaction layer, and wherein said hydrogen ion diffusion layer comprises an organic compound having a basic functional group and a hydrogen ion conductive electrolyte, and said organic compound modifies at least either surface of the catalyst particle or the carrier, which carries the catalyst particle.
3. The polymer electrolyte fuel cell in accordance with claim 2, wherein said basic functional group contains a nitrogen atom having a lone pair election.
4. The polymer electrolyte fuel cell in accordance with claim 2, wherein said organic compound having a basic functional group is a silane compound.
5. The polymer electrolyte fuel cell in accordance with claim 1, wherein said silane compound has a functional group capable of dissociating a hydrogen ion.
6. The polymer electrolyte fuel cell in accordance with claim 4, wherein said silane compound has a functional group capable of dissociating a hydrogen ion.
7. The polymer electrolyte fuel cell in accordance with claim 6, wherein said silane compound has at least either a hydrocarbon chain or a fluorocarbon chain.

8. The polymer electrolyte fuel cell in accordance with claim 4, wherein said silane compound has at least either a hydrocarbon chain or a fluorocarbon chain.

9. The polymer electrolyte fuel cell in accordance with claim 5, wherein said silane compound has at least either a hydrocarbon chain or a fluorocarbon chain

5 10. A polymer electrolyte fuel cell comprising a polymer electrolyte membrane and a pair of electrodes each having a catalytic reaction layer and a gas diffusion layer, said polymer electrolyte membrane being sandwiched by the pair of electrodes,

wherein said catalytic reaction layer contains at least a water repellent carbon material and a catalyst body comprising a hydrophilic carbon material with a catalyst particle 10 carried thereon, and wherein said catalyst is selectively disposed on the polymer electrolyte membrane side and the water repellent carbon material is disposed on the gas diffusion layer side in said catalytic reaction layer.

11. The polymer electrolyte fuel cell in accordance with claim 10, wherein said water repellent carbon material has a monomolecular layer formed by chemically bonding a 15 silane compound having a hydrophobic portion to at least a part of the carbon material surface.

12. The polymer electrolyte fuel cell in accordance with claim 10, wherein said hydrophilic carbon material has a monomolecular layer formed by chemically bonding a silane compound having a hydrophilic portion to at least a part of the carbon material 20 surface.